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Foreword

124 The *NC-SI over MCTP Binding Specification* (DSP0261) was prepared by the Platform Management
125 Components Intercommunications (PMCI Working Group) of the DMTF.

126 DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems
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148

149

Introduction

150 The *NC-SI over MCTP Binding Specification* defines new MCTP messages used to convey NC-SI Control
151 packets and Ethernet traffic over MCTP to allow NC-SI Pass-through traffic over MCTP. This specification
152 is based on the [DSP0222 1.1](#) specification and uses the same NC-SI Control packet definitions.

153 Document conventions

154 Typographical conventions

155 The following typographical conventions are used in this document:

- 156 • Document titles are marked in *italics*.
- 157 • Important terms that are used for the first time are marked in *italics*.
- 158 • Terms include a link to the term definition in the "Terms and definitions" clause, enabling easy
159 navigation to the term definition.
- 160 • ABNF rules are in `monospaced font`.

161 ABNF usage conventions

162 Format definitions in this document are specified using ABNF (see [RFC5234](#)), with the following
163 deviations:

- 164 • Literal strings are to be interpreted as case-sensitive Unicode characters, as opposed to the
165 definition in [RFC5234](#) that interprets literal strings as case-insensitive US-ASCII characters.

166

167

NC-SI over MCTP Binding Specification

168 1 Scope

169 The *NC-SI over MCTP Binding Specification* defines the bindings between NC-SI protocol elements and
170 MCTP elements in order for NC-SI Control and Pass-Through traffic to be transported using MCTP.

171 Portions of this specification rely on information and definitions from other specifications, which are
172 identified in clause 2. Two of these references are particularly relevant:

- 173 • DMTF [DSP0222](#), *Network Controller Sideband Interface (NC-SI) Specification*, provides the
174 NC-SI base control that is to be bound over MCTP by this specification.
- 175 • DMTF [DSP0236](#), *Management Component Transport Protocol (MCTP) Base Specification*,
176 defines the MCTP transport on which the NC-SI Control and Pass-through packets are to be
177 conveyed.

178 2 Normative references

179 The following referenced documents are indispensable for the application of this document. For dated or
180 versioned references, only the edition cited (including any corrigenda or DMTF update versions) applies.
181 For references without a date or version, the latest published edition of the referenced document
182 (including any corrigenda or DMTF update versions) applies.

183 Unless otherwise specified, for DMTF documents this means any document version that has minor or
184 update version numbers that are later than those for the referenced document. The major version
185 numbers must match the major version number given for the referenced document.

186 DMTF DSP0004, *CIM Infrastructure Specification 3.0*,
187 http://www.dmtf.org/standards/published_documents/DSP0004_3.0.pdf

188 DMTF DSP0222, *Network Controller Sideband Interface (NC-SI) Specification 1.1*
189 http://www.dmtf.org/sites/default/files/standards/documents/DSP0222_1.1.0.pdf

190 DMTF DSP0223, *Generic Operations 1.0*,
191 http://www.dmtf.org/standards/published_documents/DSP0223_1.0.pdf

192 DMTF DSP0236, *Management Component Transport Protocol (MCTP) Base Specification 1.3*
193 http://www.dmtf.org/standards/published_documents/DSP0236_1.3.pdf

194 DMTF DSP0237, *Management Component Transport Protocol (MCTP) SMBus/I2C Transport Binding*
195 *Specification 1.1*
196 http://www.dmtf.org/standards/published_documents/DSP0237_1.1.pdf

197 DMTF DSP0238, *Management Component Transport Protocol (MCTP) PCIe VDM Transport Binding*
198 *Specification 1.0*
199 http://www.dmtf.org/standards/published_documents/DSP0238_1.0.pdf

200 DMTF DSP0239, *Management Component Transport Protocol (MCTP) IDs and Codes 1.4*
201 http://www.dmtf.org/standards/published_documents/DSP0239_1.4.pdf

202 DMTF DSP1001, *Management Profile Specification Usage Guide 1.2*,
203 http://www.dmtf.org/standards/published_documents/DSP1001_1.2.pdf

- 204 ACPI, *Advanced Configuration and Power Interface Specification Revision 4.0a*, April 5, 2010
205 <http://www.acpi.info/DOWNLOADS/ACPIspec40a.pdf>
- 206 IETF, RFC4122, *A Universally Unique Identifier (UUID) URN Namespace*, July 2005
207 <http://www.ietf.org/rfc/rfc4122.txt>
- 208 IETF RFC5234, *ABNF: Augmented BNF for Syntax Specifications, January 2008*,
209 <http://tools.ietf.org/html/rfc5234>
- 210 ISO/IEC Directives, Part 2, *Rules for the structure and drafting of International Standards*,
211 <http://isotc.iso.org/livelink/livelink.exe?func=ll&objId=4230456&objAction=browse&sort=subtype>

212 **3 Terms and definitions**

213 In this document, some terms have a specific meaning beyond the normal English meaning. Those terms
214 are defined in this clause.

215 The terms "shall" ("required"), "shall not," "should" ("recommended"), "should not" ("not recommended"),
216 "may," "need not" ("not required"), "can" and "cannot" in this document are to be interpreted as described
217 in [ISO/IEC Directives, Part 2](#), Annex H. The terms in parenthesis are alternatives for the preceding term,
218 for use in exceptional cases when the preceding term cannot be used for linguistic reasons. Note that
219 [ISO/IEC Directives, Part 2](#), Annex H specifies additional alternatives. Occurrences of such additional
220 alternatives shall be interpreted in their normal English meaning.

221 The terms "clause," "subclause," "paragraph," and "annex" in this document are to be interpreted as
222 described in [ISO/IEC Directives, Part 2](#), Clause 5.

223 The terms "normative" and "informative" in this document are to be interpreted as described in [ISO/IEC](#)
224 [Directives, Part 2](#), Clause 3. In this document, clauses, subclauses, or annexes labeled "(informative)" do
225 not contain normative content. Notes and examples are always informative elements.

226 Refer to [DSP0236](#) for terms and definitions that are used across the MCTP specifications.

227 Refer to [DSP0222](#) for terms and definitions that are used in the NC-SI specification.

228 The terms defined in [DSP0004](#), [DSP0223](#), and [DSP1001](#) apply to this document. The following additional
229 terms are used in this document.

230 **3.1**

231 **Endpoint**

232 An MCTP endpoint unless otherwise specified.

233 **3.2**

234 **System Power States**

235 **S0 and Sx**

236 S0 represents an active system

237 Sx represents system power states S1 – S5, which reflects various levels of inactivity of a system.

238 The definition of the power states is as defined in [ACPI](#).

239 **4 Symbols and abbreviated terms**

240 The abbreviations defined in [DSP0004](#), [DSP0223](#), and [DSP1001](#) apply to this document. The following
241 additional abbreviations are used in this document.

242 **4.1**

243 **ACPI**

244 Advanced Configuration and Power Interface

245 **4.2**

246 **IANA**

247 Internet Assigned Numbers Authority

248 **4.3**

249 **FCS**

250 Frame Check Sequence

251 **4.4**

252 **MCTP**

253 Management Component Transport Protocol

254 **4.5**

255 **MC**

256 Management Controller

257 **4.6**

258 **NC**

259 Network Controller

260 **4.7**

261 **NC-SI**

262 Network Controller Sideband Interface

263 **4.8**

264 **RID**

265 PCIe Requester ID (Bus/Device/Function).

266 **5 Conventions**

267 **5.1 Reserved and unassigned values**

268 Unless otherwise specified, any reserved, unspecified, or unassigned values in enumerations or other
269 numeric ranges are reserved for future definition by the DMTF.

270 Unless otherwise specified, numeric or bit fields that are designated as reserved shall be written as 0
271 (zero) and ignored when read.

272 **5.2 Byte ordering**

273 Unless otherwise specified, byte ordering of multibyte numeric fields or bit fields is "Big Endian" (that is,
274 the lower byte offset holds the most significant byte, and higher offsets hold lesser significant bytes).

275 **6 NC-SI over MCTP overview**

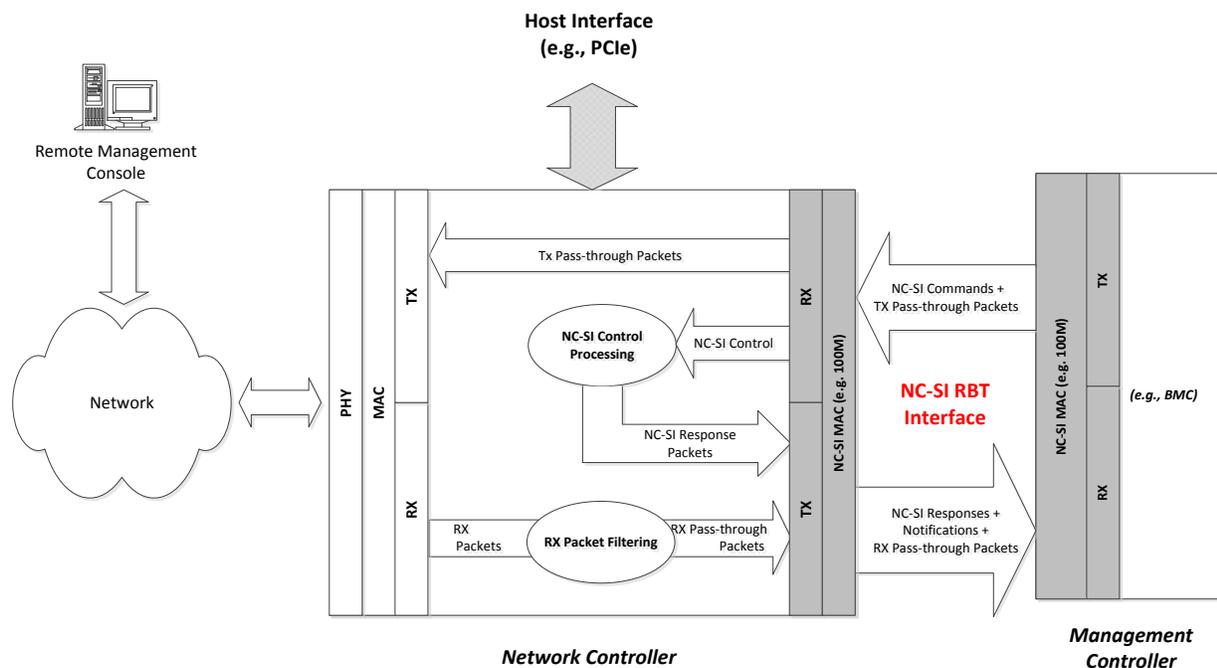
276 NC-SI over MCTP is based on DSP0222 (NC-SI). The NC-SI over MCTP Binding Specification replaces
 277 the RBT Protocol with a definition of NC-SI communications using MCTP. The MCTP Transport Bindings
 278 are defined in other companion specifications such as MCTP SMBus Binding Specification (DSP0237)
 279 and MCTP PCIe Binding Specification (DSP0238). Only the NC-SI command processing is inherited from
 280 DSP0222. Thus only parts of the NC-SI specification not related to the physical transport protocol may be
 281 relevant to this specification.

282 **6.1 NC-SI over RBT**

283 A Network Controller Sideband Interface (NC-SI) is a combination of logical and physical paths that
 284 interconnect the Management Controller and Network Controller(s) for the purpose of transferring
 285 management communication traffic among them. NC-SI includes commands and associated responses,
 286 which the Management Controller uses to control the status and operation of the Network Controller(s).
 287 NC-SI also includes a mechanism for transporting management traffic and asynchronous notifications.

288 Figure 1 depicts the NC-SI Traffic Flow Diagram as currently defined by NC-SI. As indicated, the interface
 289 is based on RBT. The figure depicts a single management controller and a single Ethernet device, which
 290 contains a single port. NC-SI comprehends multiple Network Controller devices (or “packages”) and ports
 291 (or “channels”).

292



293

294

Figure 1 – NC-SI over RBT traffic flow diagram

295

296 The DSP0222 specification can be divided in three parts. The first two parts are defined as RBT:

- 297 • A physical layer based on enhancements to the RMII specification.

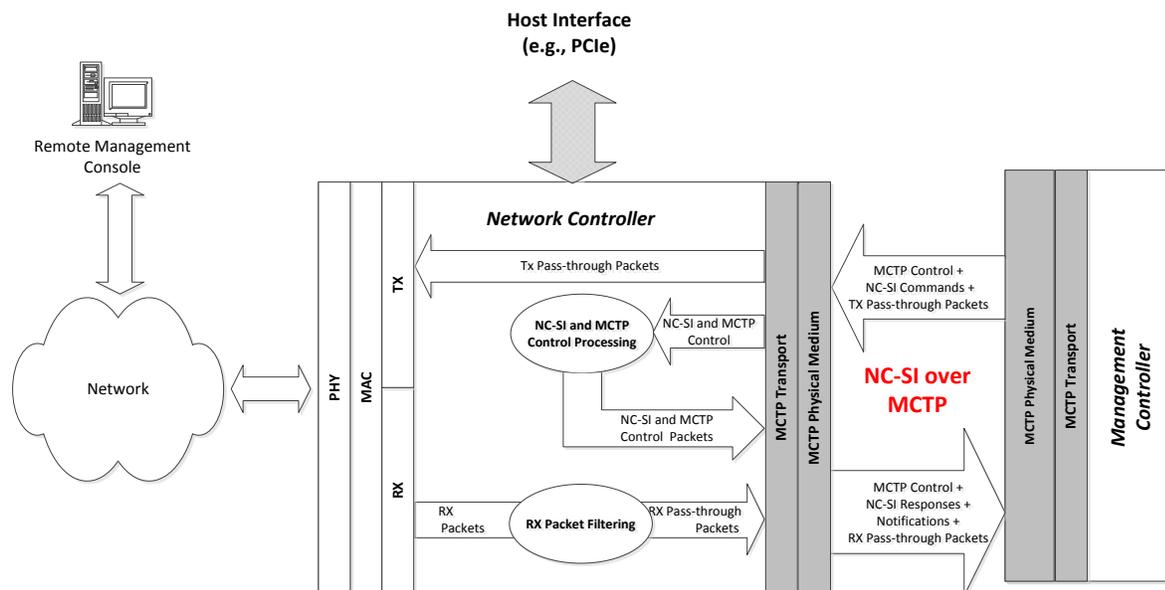
- 298 • A transport layer based on Ethernet packets. This layer allows differentiation of control frames
299 based on a specific Ethertype (0x88F8).
- 300 • A control protocol defining a set of commands allowing an MC to configure and monitor Network
301 Controllers and their Pass-through channels for MC to network communication. The command
302 set functionality can be extended using OEM commands.

303 **6.2 NC-SI over MCTP**

304 NC-SI over MCTP replaces the transport layer defined in NC-SI with MCTP. The physical layer used is
305 one of the transport bindings on which MCTP can be bound (for example, PCIe or SMBus).

306 Figure 2 shows a possible architecture that provides equivalent functionality to [\[NC-SI\]](#) over MCTP. The
307 NC-SI MAC block in each device is replaced by an MCTP block and a Medium-specific block. The MCTP
308 block handles MCTP messages. The Medium-specific blocks consist of whatever layers are involved in
309 mapping MCTP to an underlying medium such as SMBus, PCIe, or USB. Because the layering for each
310 medium may be unique in its constitution and terminology, a generic single block is depicted.

311



312

313

Figure 2 – NC-SI over MCTP traffic flow diagram

314

315 The differentiation between NC-SI Control and Pass-through packets is achieved by using two different
316 MCTP message types as defined in [DSP0239](#) and listed in Table 1.

317

Table 1 – MCTP Message types for NC-SI over MCTP

Message Type	Message Type Code	Description
NC-SI Control	0x02	Messages used to encapsulate NC-SI Control traffic (commands, responses, and AEN) over MCTP
Ethernet	0x03	Messages used to encapsulate Ethernet traffic (for example, NC-SI Pass-through) over MCTP

318

319 Both NC-SI Control and Ethernet types of MCTP messages can be conveyed over multiple MCTP
320 packets.

321 The encapsulation of NC-SI Control traffic in MCTP messages is described in subclause 9.1.1. The
322 encapsulation of NC-SI Pass-through traffic in MCTP messages is described in subclause 9.2.1.

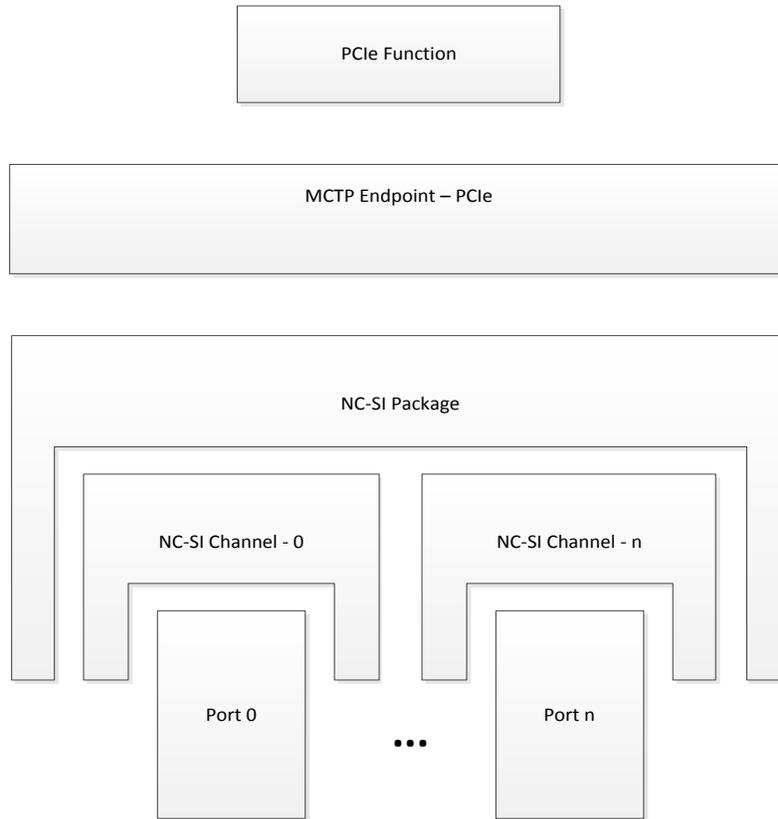
323 7 NC-SI over MCTP specific considerations

324 7.1 Packages and channels

325 The NC-SI specification defines different topologies using the concepts of channels and packages. A
326 channel is associated with a network port and a package is usually associated with a physical device that
327 exposes a single NC-SI bus. In an MCTP context, a package is related to an MCTP endpoint. Typically, a
328 package is identified by a single MCTP EID on an MCTP network.

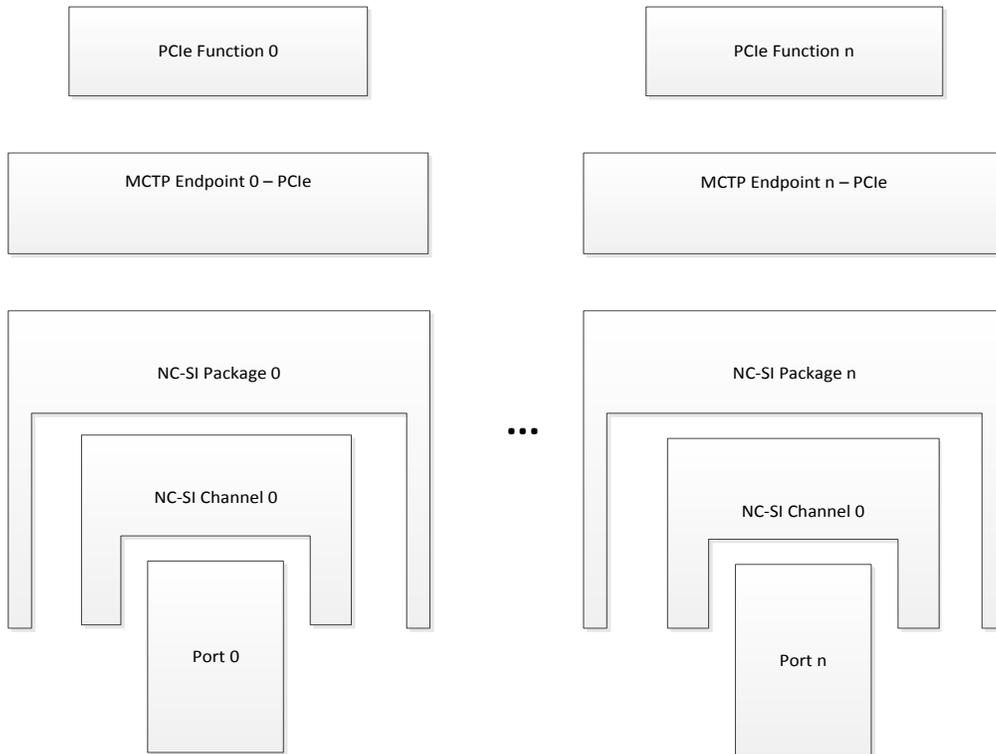
329 **NOTE** Each device may expose multiple MCTP endpoints on different transport bindings (for example PCIe and
330 SMBus). The EID on each transport binding may be different. In this case, the NC-SI package may be associated
331 with multiple EIDs but only a single EID shall be used for NC-SI over MCTP at a given moment.

332 For example, each MCTP endpoint is associated with a PCIe endpoint and its physical address (as
333 defined in [DSP0238](#)) in an MCTP over PCIe VDM transport binding implementation. A multi-function PCIe
334 device has multiple physical addresses available. Such a device may choose to expose one NC-SI
335 package with multiple NC-SI channels via a single MCTP PCIe endpoint (as described in Figure 3) or
336 multiple NC-SI packages, each package with a single NC-SI channel exposed via a dedicated MCTP
337 PCIe endpoint (as described in Figure 4).



338
339

Figure 3 – Single MCTP EID to multiple NC-SI channels mapping



340
341

Figure 4 – Multiple MCTP EIDs to multiple NC-SI channels mapping

342

343 Multiple MCTP transport bindings handling is described in subclause 7.8.

344 NOTE All the MCTP message segmentation and reassembly capabilities required are defined at the package level.

345 7.2 Routing of NC-SI Pass-through traffic

346 7.2.1 Transmit NC-SI Pass-through traffic (MC to LAN)

347 Because multiple NC-SI channels can share an EID, identification of channel is still based on the source
348 MAC address of the packet. Given the shared media behavior of RBT in multidrop configurations, packets
349 not destined to this package can be seen. In NC-SI over MCTP, the NC-SI pass-through packets are
350 routed over an MCTP network, thus packets destined to other packages are not expected. The NC should
351 drop the received NC-SI TX Pass-through packets that are not destined to its package and may count
352 them in one of the channels' Tx error counter. If counted, these errors shall be included in the "Pass-
353 through TX Packets Dropped" counter as part of the Get NC-SI Pass-through Statistics Response.

354 7.2.2 Receive NC-SI Pass-through traffic (LAN to MC)

355 The forwarding of network traffic to the MC shall use the same rules as defined in DSP0222.

356 7.3 Multiple NC support

357 7.3.1 NC-SI arbitration support

358 In the original NC-SI specification, hardware and command-based arbitration are defined as ways to
359 share an inherently point-to-point media between different NCs. With MCTP, the media itself may provide
360 other means to arbitrate between different NCs. Thus, there is no need to use NC-SI HW arbitration
361 method to arbitrate between multiple NCs on an MCTP network.

362 An NC supporting the NC-SI over MCTP binding shall retain the support for the 'select package' and
363 'deselect package' commands to allow control of asynchronous transmission from the NC.

364 7.4 Flow control

365 7.4.1 Flow control for MCTP packets

366 A physical medium supporting NC-SI over MCTP communication shall be able to buffer at least one NC-
367 SI Control or Ethernet message at the rate of the physical layer. Flow control of MCTP packets between
368 the Network Controller and the Management Controller (if any) may be handled by the flow control
369 mechanisms that are specified for that particular MCTP Transport Binding for a physical medium. For
370 example, a network controller may use the SMBus clock stretching mechanism to delay the reception of
371 MCTP packets or may drop such packets.

372 7.4.2 Flow control for NC-SI over MCTP Control messages

373 Flow control of NC-SI Control over MCTP messages is handled by the request/response protocol used for
374 those messages. The Network Controller shall be able to process a single NC-SI command at a time from
375 the Management Controller. The Management Controller shall wait until getting a NC-SI response to that
376 NC-SI command, or for a response timeout, before sending another NC-SI command over MCTP to that
377 NC.

378 7.4.3 Flow control for NC-SI Pass-through packets.

379 The NC-SI Pass-through traffic flow control used in RBT is an Ethernet-specific technology that is not well
380 suited to an MCTP transport. An implementation of this specification may support Ethernet flow control,

381 but it will apply only to Ethernet messages (message type – 0x3) and not to messages of NC-SI Control
382 over MCTP type (message type – 0x2). The method used to control the rate of transmission of Ethernet
383 packets is beyond the scope of this specification.

384 **7.5 Interleaving of messages**

385 **7.5.1 Interleaving of MCTP Control and NC-SI messages**

386 According to the MCTP specification [[MCTP](#)], an endpoint shall accept MCTP Control messages that are
387 interleaved among NC-SI Control over MCTP or Ethernet over MCTP message packets. This is to avoid
388 scenarios where functions such as the MCTP bus owner are 'locked out' from managing the MCTP bus
389 because of NC-SI Pass-through traffic.

390 Correspondingly, MCTP Control Message responses shall be able to be interleaved among incoming NC-
391 SI Control over MCTP or Ethernet over MCTP message packet. However, the MCTP Control Message
392 responses may be held up and transmitted between Ethernet Messages, provided that the MCTP
393 command request-to-response timing requirements are met.

394 **7.5.2 Interleaving of NC-SI Control and Ethernet over MCTP messages**

395 NC-SI Control over MCTP and Ethernet over MCTP messages to the same EID shall not be interleaved.
396 Similar to the [DSP0222](#) specification case, NC-SI Control and Ethernet packets are interleaved at the
397 message level. An MC operating with multiple NC may interleave messages sent to different NCs.
398

399 **7.6 Ordering rules for NC to MC traffic**

400 The following table defines which type of messages should pass other types of packets to avoid
 401 deadlocks. The decisions are done at a message level. Interleaving within messages is defined in the
 402 previous sections. The following behaviors are expected:

- 403 • Yes—the second message (row) shall be allowed to pass the first (column) to avoid deadlock
 404 (When blocking occurs, the second message is required to pass the first message)
- 405 • Y/N—there are no requirements. The second message may optionally pass the first message or
 406 be blocked by it as long as the timing specifications for the messages are met.
- 407 • No—the second message shall not be allowed to pass the first message. This is required to avoid
 408 out of order events.

409

Row Pass Column?	MCTP Control response (Col 1)	NC-SI response (Col 2)	NC-SI AEN (Col 3)	Ethernet Packet (Col 4)
MCTP Control response (Row A)	Y/N	Y/N	Yes	Y/N
NC-SI response packet (Row B)	Y/N	Y/N	Yes	Y/N
NC-SI AEN (Row C)	Y/N	Y/N	No	Y/N
Ethernet packet (Row D)	Y/N	Y/N	Y/N	No

410 **Notes** (The letter and number indicates the row and column in the table above):

411

- 412 • **A** This row relates only to the precedence of MCTP base control messages
 413 over NC-SI and Ethernet messages and not over other MCTP message
 414 types.
- 415 • **A1** This situation will occur only in NCs accepting multiple outstanding
 416 MCTP control commands.
- 417 • **B2** This situation will occur only in NCs accepting multiple outstanding NC-
 418 SI commands.
- 419 • **A3, B3** An NC-SI AEN may be blocked if the channel is disabled or the package
 420 deselected. Thus it should not block MCTP Control or NC-SI responses.
- 421 • **C3** AENs should be sent in order of occurrence to avoid cases where the
 422 latest received status is obsolete. For example in the case of a link-down
 423 event followed by a link-up event, the AEN on the link-up event must not
 424 pass the AEN on the link-down event.
- 425 • **D4** Ethernet packets must be sent in order to avoid out-of-order events in
 426 the upper layers.

427 **7.7 Assembly requirements**

428 According to the interleaving requirements described in subclause 7.5, the NC shall be able to assemble
 429 a single NC-SI Control or Ethernet over MCTP message at a time. The maximum Ethernet packet size is
 430 defined in subclause 9.2. The maximum NC-SI packet size is defined in subclause 9.1.

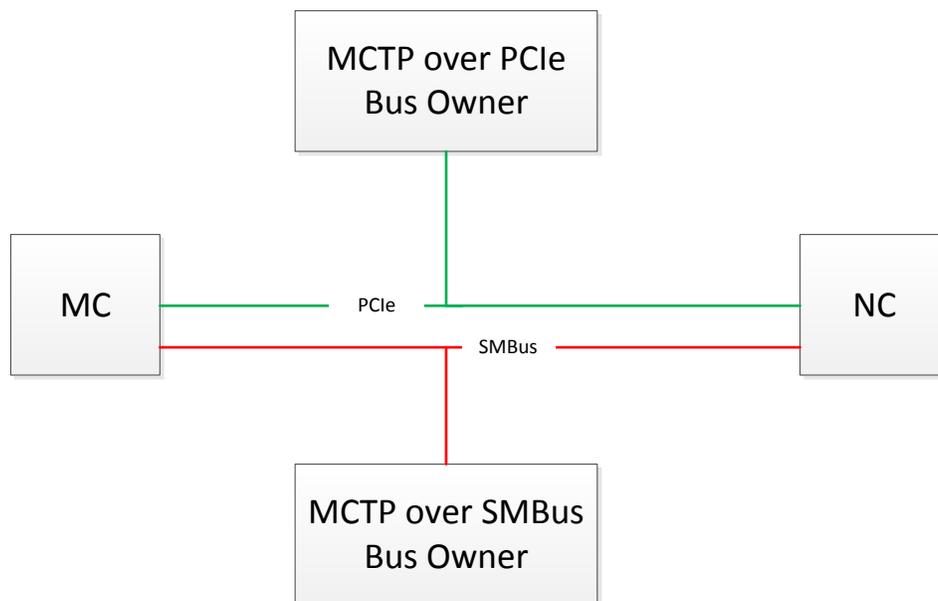
431 Buffering requirements for other message types are not covered in this specification.

432 **7.8 Multiple MCTP transport bindings**

433 In the DSP0222 specification, the channels use a single physical interface all the time. In NC-SI over
 434 MCTP, multiple MCTP transport bindings may be used at different times to convey NC-SI traffic to allow
 435 tradeoffs between data rate and power consumption. The following requirements apply to those MCTP
 436 transport bindings:

- 437 1) NC-SI control messages (identified by MCTP message type 0x2) shall be supported
- 438 2) Ethernet messages (identified by MCTP message type 0x3) may be supported

439 Figure 5 shows an example of multiple MCTP transport bindings using MCTP over PCIe VDM and MCTP
 440 over SMBus. The types of NC-SI over MCTP traffic on each MCTP transport binding may vary as
 441 described above.



442 **Figure 5 – Multiple MCTP transport bindings example**

444 **7.8.1 Supported message types over different MCTP transport bindings**

445 An endpoint may support different MCTP message types over different MCTP transport bindings. For
 446 example, an NC may choose to support Ethernet message type over MCTP PCIe VDM transport only. It
 447 is recommended that an MC initially determines the supported message types on a given medium during
 448 the discovery phase using the Get Supported Message Type MCTP Control command prior to
 449 transmitting MCTP traffic of specific MCTP message type on the medium.

450

451 **7.8.2 MCTP EID and physical address changes.**

452 The NC-SI package mapping of the NC or the MC to MCTP EID and/or physical interface address may
453 change due to the following reasons:

- 454 1) Changes in the MCTP transport medium used. For example moving from PCIe to SMBus
455 medium when PCIe becomes unavailable for MCTP communication due to change of
456 power state.
- 457 2) Changes in the EID to physical address mapping. For example when changing medium or
458 during re-enumeration process or in a multifunction PCIe device, if the function of which
459 RID is being used is disabled by the host, the MCTP endpoint may move to another
460 function.

461 In order to avoid breakup of network connections, and in order to avoid the need to reconfigure the NC,
462 the NC-SI connection should be kept alive during the transition. The MC is responsible for the
463 reconnection of the channel in case of address mapping changes. The next clause describes possible
464 flows that may be used to ease the re-discovery of an NC whose address has changed. A flow by which
465 the MC can expose a change of its own address to the NC(s) is described in subclause 7.8.4.

466 According to the [MCTP](#) specification, an MC or NC that has its physical address changed should send an
467 MCTP Discovery Notify command to the bus owner so that the routing tables can be updated.

468 **7.8.3 NC discovery flows**

469 The MC may use one of the following example flows to discover a NC whose address has changed.

470 **7.8.3.1 Full discovery**

471 The simplest and most time consuming method is to discover the NC partner by using the standard
472 MCTP discovery method. This method works with NCs that support at least MCTP 1.1 and NC-SI 1.0.

473 The following flow may be used:

- 474 • The MC detects a potential address update condition (for example: power state change, link
475 status change, or re-enumeration) or detects an NC-SI timeout condition (as defined in section
476 6.8.2.1 of [NC-SI](#)).
- 477 • The MC finds all the endpoints in the system by sending an MCTP “Get Routing Table Entries”
478 command to the bus owner and to any bridges in the MCTP network.
- 479 • For each device listed, the MC checks whether it supports the required MCTP message types
480 (NC-SI Control and optionally Ethernet) by using the MCTP “Get Message Type Support”
481 command.

482 For each potential endpoint discovered by using the method above, the MC checks whether it is the
483 original NC partner, for example by sending an “Get Version ID” NC-SI command to the original NC ID
484 and checking the response.

485 **7.8.3.2 UUID based discovery**

486 This method is based on the usage of the “Resolve UUID” MCTP command.

487 To use this method, the bus owner or bridge must support the “Resolve UUID” MCTP command and the
488 NC must support the “Get Endpoint UUID” MCTP command.

489 The following flow may be used:

- 490 • When the NC-SI channel is first established by using some proprietary method (for example by
491 using the flow from the previous section), the MC may send a “Get Endpoint UUID” MCTP
492 command to the NC. It then keeps the UUID information for future use.
- 493 • MC periodically sends a “Get Routing Table” Command to the bus owner to receive updated
494 endpoints addresses.
- 495 • The NC whose address changes or that wants to move to another active bus sends a “Discovery
496 Notify” MCTP command to the bus owner of the new bus.
- 497 • As part of the routing table update, the bus owner sends a “Get Endpoint UUID” MCTP command
498 to the NC and updates its routing table accordingly.
- 499 • The MC sends a “Resolve UUID” MCTP Command to the bus owner by using the previously
500 saved NC UUID. In response, it gets the list of EIDs matching this UUID.
- 501 • The MC can check if the relevant message types (NC-SI Control and optionally Ethernet) are
502 supported on the new bus by using an MCTP “Get Message Type Support” command.
- 503 • The MC may then send any NC-SI Command to the NC to communicate with the NC on the new
504 medium.

505 7.8.3.3 NC-SI based discovery

506 The NC must support the “Get Supported Media” NC-SI command as defined in clause 10.1 to use this
507 method.

508 The following flow may be used.

- 509 • The MC detects a potential address update condition (for example: power state change, link
510 status change, AEN from the NC, or re-enumeration) or detects a timeout condition on NC-SI (as
511 defined in section 6.8.2.1 of [NC-SI](#)).
- 512 • If the original bus is still available (for example, when transitioning from SMBus to PCIe), it may
513 send on the original bus a “Get Supported Media” NC-SI command. In the response, the NC will
514 provide information on the routing that should be used on the new bus and on the support for
515 Pass-through on this bus.
- 516 • The MC may then send any NC-SI Command to the NC to communicate with the NC on the new
517 medium.

518 This method may not be applicable when there is no active channel that can be used to send the “Get
519 Supported Media” NC-SI command over. In this case, one of the other methods should be used.

520 7.8.4 MC update flow

521 In the case where MC physical address or its MCTP EID changes, it may send an “Enable Channel” NC-
522 SI command to the NC. This command will update the MC EID and physical address used by the NC.

523 7.8.5 Transition between mediums

524 A transition of an NC-SI package from one medium to another can occur due to changes in the available
525 media. For example, a transition from SMBus to PCIe can occur when PCIe becomes available to provide
526 a larger bandwidth.

- 527 A transition of an NC-SI from one medium to another is achieved when the NC is deselected on the first
528 medium and selected on the second medium as described in subclause 7.9.
- 529 The NC may notify the MC about the state of a medium using an AEN.
- 530 1) Potential loss of a medium prior to losing the medium
531 2) Availability of a new medium
- 532 Alternatively, the MC may be aware of the medium change independently, for example, by detecting its
533 own PCIe bus became active, by interaction with the BIOS, and so on.
- 534 The MC may initiate the transition by using MCTP Control and NC-SI Control messages as described in
535 subclause 7.8.5.1.
- 536 A transition can be between mediums with different levels of support of Ethernet MCTP messages.
- 537 When an NC transitions from a medium on which Ethernet messages were supported to a second
538 medium on which Ethernet messages are not supported, the NC should stop sending and receiving
539 Ethernet messages on the first medium after the NC-SI channel had been deselected on the first medium.
- 540 The MC may transition back later to the first medium for communicating Ethernet messages. If the MC
541 transitions back to the first medium supporting Ethernet messages, it may resume communications of
542 Ethernet messages based on the previous configuration. If the configuration was lost during the
543 transitions, the NC shall return to the NC-SI Initial State (as described in section 6.2.4 of [NC-SI](#)).
- 544 Even if NC-SI Pass-through traffic (Ethernet messages) is supported over multiple mediums, Pass-
545 through traffic shall not be transitioned to a new medium before the connection between the MC and the
546 NC is re-established on the new medium. The NC shall support the following flows to initiate a transition
547 to the new medium:
- 548 • If the current medium is still active (for example when moving from SMBus to PCIe to achieve
549 better throughput), the NC shall keep its Pass-through traffic on the original medium (both MC to
550 network and network to MC). The NC shall also send outstanding NC-SI responses on the
551 original medium.
552 NOTE The MC can stop the traffic from the NC on the current medium by sending “Disable Channel” and
553 “Disable Channel Network TX” NC-SI commands to all the channels before the transition. In this case, it
554 shall send “Enable Channel” and “Enable Channel Network TX” NC-SI commands to all active channels on
555 the new medium, to allow the traffic to resume.
 - 556 • If the current medium is inactive (for example, when moving from PCIe to SMBus due to a power
557 transition), the NC shall stop transferring Ethernet messages. If a packet is being transmitted by
558 the NC when the original medium becomes unavailable, the NC shall not continue the
559 transmission of the packet and the packet may be lost. Outstanding NC-SI responses may be
560 discarded by the NC.
 - 561 • When any NC-SI command is received from the MC on the new medium (apart from “*Deselect*
562 *Package*”), the NC shall move to “Selected” state on the new medium (see subclause 7.9).
 - 563 ○ An NC-SI Rx Pass-through message to the MC on the current medium shall be
564 completed by the NC on the current medium and only after that shall the NC send the
565 NC-SI response to the MC on the new medium.
 - 566 ○ The next Pass-through message sent to the MC after a successful response to the NC-SI
567 command shall be sent on the new medium.

568 • The NC shall accept Pass-through traffic from the MC on the new medium after the NC moves to
569 "Selected" state on the new medium and sends the first successful NC-SI response.

570 • The same algorithm as described above shall be used for the selection of the medium to use for
571 sending NC-SI AEN messages to the MC.

572 An NC that uses multiple MCTP transport bindings should support at least one of the UUID based
573 recovery or the NC-SI based recovery methods in addition to the Full Discovery mechanism.

574 **7.8.5.1 MC transition flow**

575 The MC can initiate a transition between mediums for one of the following reasons.

576 1) Loss of medium for NC-SI over MCTP communications. For example, system transitioning
577 into a low power state may make PCIe medium unavailable for NC-SI over MCTP
578 communications over PCIe VDM transport.

579 2) Reception of an AEN from the NC notifying a medium state change. For example, an NC
580 may notify the MC about the potential loss of the PCIe medium, triggering a transition to
581 SMBus.

582 The following flow can be used by the MC to initiate a transition between mediums:

583 • If the current medium is still active (for example when moving from SMBus to PCIe to achieve
584 better throughput), the MC can keep its traffic on the original medium until it discovers the NC by
585 using one of the flows described in subclause 7.8.3. If the current medium is inactive (for
586 example, when moving from PCIe to SMBus due to a power transition), the MC will stop
587 transferring Ethernet messages with NC until discovery of the NC.

588 • The MC can then send an "Enable Channel" NC-SI Command, or any other command to the NC
589 to select it on the new medium. The MC will then wait for the NC response before starting to send
590 packets on the new medium. The MC will complete transmission of the current Ethernet message
591 before sending the command and will not send Ethernet messages while waiting for the
592 response. The MC will accept Ethernet message on the original medium until the response from
593 the NC is received on the current medium.

594 • If Pass-through is supported by the NC over only a single medium, when transitioning out of this
595 medium, the MC will not send Pass-through traffic to the NC and will not expect to receive traffic
596 from the NC.

597 • If a medium becomes unavailable while an MC waits for an NC-SI command response, it can
598 assume the command was lost and retry it on the new medium.

599 **7.9 Package selection**

600 The "Selected" state of an NC-SI package is defined for each of the MCTP transports to which it can bind.
601 A package can be selected only on a single MCTP medium at a given point of time.

602 As in DSP0222, a package is selected by reception of a "Select Package" on the MCTP medium or any
603 other command except "Deselect Package".

604 A package is deselected on a specific MCTP medium by reception of a "Deselect Package" command,
605 selection of the package on another medium or if the physical medium on which it operate becomes
606 unavailable. If the packet is deselected by an NC-SI command it should move to the deselected state only
607 after sending a response to the command.

608 A package is allowed to send Ethernet messages or NC-SI Control messages on an MCTP medium only
609 if in the "Selected" state on that medium.

610 An NC should use the source EID and source physical address received from the last received NC-SI
 611 command to respond to this command and as the destination of subsequent Ethernet messages. If a
 612 command is received during the transmission of an Ethernet message, the destination should change
 613 only at the beginning of the next message.

614 The channel selection state and all other NC-SI configurations may be kept during the transition from one
 615 medium to another. If the configuration is altered during the transition, the NC shall return to Initial State.

616 **8 Supported NC-SI commands**

617 The supported NC-SI commands when bound to MCTP is a subset of the commands in [DSP0222](#)
 618 specification. The subset of supported commands varies according to the supported messages as
 619 indicated in the response to the Get Message Type Support MCTP Control command. If only the NC-SI
 620 Control message type is supported, the commands related to the Pass-through traffic control are not
 621 supported. If both the NC-SI Control and Ethernet message types are supported, these commands are
 622 supported. Table 2 lists the supported commands according to the supported message types.

623 Optional commands may have different implementation over different media.

624 Note that some commands are not applicable for MCTP binding and are listed here only for
 625 completeness. These commands are marked as “Not part of binding”.

626

627

Table 2 – Supported NC-SI commands

Command Type	Command Name	Description	Response Type	Command Support Requirement NC-SI Control Messages Only	Command Support Requirement NC-SI Control and Ethernet Messages
0x00	Clear Initial State	Used by the Management Controller to acknowledge that the Network Controller is in the Initial State	0x80	M	M

Command Type	Command Name	Description	Response Type	Command Support Requirement NC-SI Control Messages Only	Command Support Requirement NC-SI Control and Ethernet Messages
0x01	Select Package	Used to explicitly select a controller package to transmit packets through the NC-SI interface	0x81	O3	O ³
0x02	Deselect Package	Used to explicitly instruct the controller package to stop transmitting packets through the NC-SI interface	0x82	O ³	O ³
0x03	Enable Channel	Used to enable the NC-SI channel and to start the forwarding of bidirectional Management Controller packets	0x83	M	M
0x04	Disable Channel	Used to disable the NC-SI channel and to stop the forwarding of bidirectional Management Controller packets	0x84	M	M
0x05	Reset Channel	Used to synchronously put the Network Controller back to the Initial State	0x85	M	M
0x06	Enable Channel Network TX	Used to explicitly enable the channel to transmit Pass-through packets onto the network	0x86	N/A	M
0x07	Disable Channel Network TX	Used to explicitly disable the channel from transmitting Pass-through packets onto the network	0x87	N/A	M
0x08	AEN Enable	Used to control generating AENs	0x88	C	C
0x09	Set Link	Used during OS absence to force link settings, or to return to auto-negotiation mode	0x89	O	M
0x0A	Get Link Status	Used to get current link status information	0x8A	O	M
0x0B	Set VLAN Filter	Used to program VLAN IDs for VLAN filtering	0x8B	N/A	M
0x0C	Enable VLAN	Used to enable VLAN filtering of Management Controller RX packets	0x8C	N/A	M
0x0D	Disable VLAN	Used to disable VLAN filtering	0x8D	N/A	M
0x0E	Set MAC Address	Used to configure and enable unicast and multicast MAC address filters	0x8E	N/A	M
0x10	Enable Broadcast Filtering	Used to enable full or selective broadcast packet filtering	0x90	N/A	M

Command Type	Command Name	Description	Response Type	Command Support Requirement NC-SI Control Messages Only	Command Support Requirement NC-SI Control and Ethernet Messages
0x11	Disable Broadcast Filtering	Used to disable all broadcast packet filtering, and to enable the forwarding of broadcast packets	0x91	N/A	M
0x12	Enable Global Multicast Filtering	Used to disable forwarding of all multicast packets to the Management Controller	0x92	N/A	C
0x13	Disable Global Multicast Filtering	Used to enable forwarding of all multicast packets to the Management Controller	0x93	N/A	C
0x14	Set NC-SI Flow Control	Used to configure IEEE 802.3 flow control on NC-SI	0x94	N/A	O
0x15	Get Version ID	Used to get controller-related version information	0x95	M	M
0x16	Get Capabilities	Used to get optional functions supported by the NC	0x96	M ¹	M
0x17	Get Parameters	Used to get configuration parameter values currently in effect on the controller	0x97	M ²	M
0x18	Get Controller Packet Statistics	Used to get current packet statistics for the Network Controller	0x98	O	O
0x19	Get NC-SI Statistics	Used to request the packet statistics specific to the NC-SI interface	0x99	O	O
0x1A	Get NC-SI Pass-through Statistics	Used to request NC-SI Pass-through packet statistics	0x9A	N/A	O
0x1B	Get Package Status	Used to get current status of the package	0x9B	O	O
0x50	OEM Command	Used to request vendor-specific data	0xD0	O	O
0x52	Get Package UUID	Returns a universally unique identifier (UUID) for the package	0xD2	O	O
0x53	Reserved	Reserved for RBT binding	0xD3	Not part of binding	Not part of binding

Command Type	Command Name	Description	Response Type	Command Support Requirement NC-SI Control Messages Only	Command Support Requirement NC-SI Control and Ethernet Messages
0x54	Get Supported Media	Used to return the media on which NC-SI can run and routing information for each medium.	0xD4	O	O
0x55	Transport Specific AEN Enable	Used to control generating Transport specific AENs	0xD5	O	O
Key: M = Mandatory (required) O = Optional C = Conditional (see command description) N/A = Not applicable					
1. The only part of the response that is relevant is the AEN control support field. 2. The only part of the response that is relevant is the Link Settings, AEN control fields and the Channel Enabled flag in the Configuration Flags. 3. The 'Select Package' and 'Deselect Package' commands impact only transmission of NC-SI Control and Ethernet over MCTP message types and do not impact other MCTP message types.					

628 **9 Message types**

629 The MC and the NC shall support the NC-SI over MCTP message type (0x02). The Ethernet message
 630 type should be supported if NC-SI Pass-through traffic is expected on this interface.

631 **9.1 NC-SI message type (0x02)**

632 This message type is used to carry NC-SI Control packets that are identified by the NC-SI Ethertype in
 633 the DSP0222 specification. This includes command, response, and AEN packets.

634 The maximum NC-SI message payload size is 1500 bytes to keep the same limit as in [NC-SI](#). This
 635 includes the payload starting from the MC ID field.

636 **9.1.1 Encapsulation**

637 The encapsulation of NC-SI Control packets includes the packet as described in the Control packet data
 638 structure of [DSP0222](#) specification encapsulated in an MCTP header. NC-SI messages may be
 639 fragmented to multiple MCTP packets.

640 NC-SI control packets communicated over MCTP do not follow the Ethernet frame encapsulation defined
 641 in DSP0222 for NC-SI over RMI Based Transport (RBT) transport binding. NC-SI control packets over
 642 MCTP shall not include Ethernet frame header, Ethernet packet pad, and Ethernet Frame Check
 643 Sequence (FCS). Instead, the encapsulation described in Table 3 shall be used to encapsulate NC-SI
 644 control messages.

645 NOTE The Control packets frames in DSP0222 uses a DA, SA, and Ethertype MAC header. The DA and SA part
 646 do not contain any useful data and the Ethertype is used to differentiate between Control packets and Ethernet traffic.
 647 In NC-SI over MCTP, this Ethernet framing is not used, as the differentiation is achieved through usage of different
 648 message types.

649

650

Table 3 –NC-SI messages encapsulation

Bytes	+0				+1				+2				+3										
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1
00..03	RSVD				Header Version				Destination Endpoint ID				Source Endpoint ID				S	E	Pkt		T	Message	
																	O	O	seq #	O	Tag		
																	M	M					
04..07	IC	Message Type			MC ID				Header Revision				Reserved										
	0	0x02																					
08..11	IID				Command				Channel ID				Reserved		Payload Len								
12..15	Payload Length				Reserved																		
16..19	Reserved																						
20..23	Reserved				Control Packet Payload																		
...	...																						
...	...				Control Packet Payload				Payload Padding (as required)														
...	Payload Padding (as reqrd)				Checksum 3:1																		
...	Checksum 0																						

651

652 See [NC-SI](#) for details of the NC-SI Control packets format.

653 The following tables describe the value for the various fields of the message whose description differs
 654 from the description in the MCTP or NC-SI specification.

655

Table 4 - MCTP Transport Header fields

Field Name	Field Size	Value	Comment
Tag Owner (TO)	1 bit	Varies	Indicates that the Tag field value was generated by the message source = 0b Tag not from message source = 1b Tag from message source. Should be set for Commands and AEN packets. Should be cleared for Response packets.
Msg Tag	3 bits	Varies	The Tag field shall be set by the source of the message.

656

657

658

Table 5 – MCTP Specific Message Header field

Field Name	Field Size	Value	Comment
IC Bit	1 bit	0b	NC-SI over MCTP does not define message integrity check as it relies on the MCTP packet integrity check provided by the underlying medium or checks that are encapsulated in the message payload. This field is present only in the first packet of a message (SOM = 1).
Message Type	7 bits	0x02	Identifies the MCTP message type as an NC-SI Control over MCTP message. This field is present only in the first packet of a message (SOM = 1).

659 **9.1.2 Version**

660 The version that shall be reported for this message type in the Get MCTP Version Support response is
661 0xF1F0F000 (1.0.0)

662 **9.2 Ethernet message type (0x03)**

663 This message type is used to carry NC-SI Pass-through packets. Ethernet messages may be fragmented
664 to multiple MCTP packets.

665 The nominal Ethernet message size that shall be supported is 1518 bytes to accommodate a full Ethernet
666 packet including a VLAN but without FCS. If additional L2 tags are expected (for example, MACSec), the
667 supported packet size shall increase accordingly.

668 **9.2.1 Encapsulation**

669 The encapsulation of Ethernet packets includes the entire Ethernet frame from the Source MAC address
670 to the end of the payload, not including the FCS, prefixed with an MCTP header.

671 NOTE In [NC-SI](#), the FCS was required as part of the Ethernet encapsulation used over RMII. When Ethernet
672 packets are sent over other mediums, the medium specific error recovery mechanisms are used and the FCS is not
673 required.

674 The FCS should be added by the NC for packets sent by the MC to the network and should be checked
675 and removed by the NC for packets received from the network to the MC. Packets with a wrong FCS
676 should not be forwarded to the MC.

677 This behavior is consistent with the FCS offload provided by NCs to the host OS.

678

Table 6 – Ethernet messages encapsulation

Bytes	+0				+1				+2				+3																	
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0						
00..03	RSVD				Header Version				Destination Endpoint ID				Source Endpoint ID				S	E	Pkt	T	Message	O	O	seq #	O	Tag	M	M		
04..07	IC	Message Type							Destination Address5:3																					
08..11	Destination Address 2:0											Source Address 5																		
12..15	Source Address 4:1																													
16..	Source Address 0				Optional L2 tags																									
...	Optional L2 tags				Ethertype								Ethernet Payload																	
...	Ethernet Payload (no FCS)																													

679

680 The following tables describe the value for the various fields of the message whose description differs
 681 from the description in the MCTP or NC-SI specification.

682

Table 7 - MCTP Transport Header fields

Field Name	Field Size	Value	Comment
Tag Owner (TO)	1 bit	1b	Indicates that the Tag field value was generated by the message source = 0b Tag not from message source = 1b Tag from message source Should be set for all packets
Msg Tag	3 bits	Varies	The Tag field shall be set by the source of the message.

683

Table 8 – MCTP Specific Message Header field

Field Name	Field Size	Value	Comment
IC Bit	1 bit	0b	NC-SI over MCTP does not define a message integrity check because it relies on the MCTP packet integrity check provided by the underlying medium or checks that are encapsulated in the message payload. This field is present only in the first packet of a message (SOM = 1).
Message Type	7 bits	0x03	Identifies the MCTP message type as an Ethernet over MCTP message. This field is present only in the first packet of a message (SOM = 1).

684 **9.2.2 Version**

685 The version that shall be reported for this message type in the Get MCTP Version Support response is
 686 0xF1F0F000 (1.0.0)

687 **10 NC-SI support specific to MCTP transport**

688 The following commands and AEN may be implemented as part of this specification to allow an
 689 implementation of the discovery flow described in clause 7.8.3.3.

690 **10.1 Get Supported Media Command (0x54)**

691 This command is used to query a device about the Media on which NC-SI can be conveyed. This
 692 command is optional and is applicable only if more than one media is supported.

693 The Get Supported Media command is addressed to the package, rather than to a particular channel (that
 694 is, the command is sent with a Channel ID where the Package ID subfield matches the ID of the intended
 695 package and the Internal Channel ID subfield is set to 0x1F).

696 Table 9 illustrates the packet format of the Get Supported Media command.

697 **Table 9 – Get Supported Media Command Packet Format**

Bytes	Bits			
	31..24	23..16	15..08	07..00
00..15	NC-SI Header			
16..19	Checksum			
20..45	Pad			

698 **10.2 Get Supported Media Response (0xD4)**

699 In the absence of any error, the package shall process and respond to the Get Supported Media
 700 command by sending the response packet and payload shown in Table 10.

701 **Table 10 – Get Supported Media Response Packet Format**

Bytes	Bits			
	31..24	23..16	15..08	07..00
00..15	NC-SI Header			
16..19	Response Code		Reason Code	
20..23	Reserved			Number of medias supported
24..	Media descriptors as described in Table 11. The number of media descriptors is according to the Number of medias supported field value.			
...	Checksum			
...	Pad			

702

703

Table 11 – Get Supported Media Response media descriptors format

Byte	Description
0	EID. Should be 0x0 if Physical Medium Identifier is RBT.
1	Physical Transport Binding Identifier, according to MCTP ID specification (DSP0239). Should be 0x0 if Physical Medium Type Identifier is RBT.
2	Physical Medium Identifier, according to MCTP ID specification (DSP0239). This value is used to indicate what format the following physical address data is given in.
3.0	NC-SI Pass-through is supported. 0: NC-SI Pass-through is not supported over this medium. 1: NC-SI Pass-through is supported over this medium.
3.6:1	Reserved
3.7	Status0: Medium is not currently available for NC-SI. 1: Medium is currently available for NC-SI.
4	Physical Address Size. Should be 0x0 if Physical Medium Identifier is NC-SI over RBT according to MCTP ID specification.
5:N	Physical Address. This field is not present if Physical Medium Identifier is RBT. If present, this field is valid only if the Status bit is set and its value is unspecified otherwise.

704 **10.3 Transport Specific AENs Enable (0x55)**

705 Network Controller implementations shall support this command on the condition that the Network
 706 Controller generates one or more transport specific AENs defined in this specification. The AEN Enable
 707 command enables and disables the different transport specific AENs supported by the Network
 708 Controller. The Network Controller shall copy the AEN MC ID field from the Transport Specific AEN
 709 Enable command into the MC ID field in every subsequent AEN sent to the Management Controller as
 710 defined in [DSP0222](#).

711 Table 12 illustrates the packet format of the Enable Transport Specific AENs command.

712 The current version of this command only supports the Medium Change AEN.

713

Table 12 –Transport Specific AENs Enable Command Packet Format

Bytes	Bits			
	31..24	23..16	15..08	07..00
00..15	NC-SI Header			
16..19	Reserved	AEN MC ID	Transport Specific AENs enable	
20..23	Checksum			
24..45	Pad			

714 **Table 13 –Transport Specific AENs enable field format**

Bit Position	Field Name	Value Description
0	Medium Change AEN Control (0x70)	0b = Disable Medium Change AEN 1b = Enable Medium Change AEN
1..15	Reserved For future AEN	Reserved

715

716 **10.4 Transport Specific AENs Enable Response (0xD5)**

717 In the absence of any error, the package shall process and respond to the Transport Specific AENs
718 Enable command by sending the response packet and payload shown in Table 14.

719 **Table 14 –Transport Specific AENs Enable Response Packet Format**

Bytes	Bits			
	31..24	23..16	15..08	07..00
00..15	NC-SI Header			
16..19	Response Code		Reason Code	
20..23	Checksum			
...	Pad			

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721 **10.5 Medium Change AEN**

722 The Medium change AEN is used to alert the MC that there was a status change in one of the media
723 supported by the NC, or such a change is expected according to some external or internal condition
724 detected by the NC.

725 This AEN should be sent if any change occurred in the status of one of the media supported by the
726 device. It may also be sent for expected changes in the medium status, if the NC is aware of them.

727 For example, if while NC-SI package is active over SMBus, the PCIe bus becomes available, this AEN
728 should be sent. Another example, if while NC-SI package is active over PCIe, the NC detects that the
729 PCIe bus is going to be disabled, it may send this AEN also.

730 In a multichannel package, the AEN, if enabled, should be sent only once per medium change event. If
731 enabled on multiple channels, the AEN may be sent on any of the channels on which this AEN is
732 enabled.

733 The media descriptors field reproduces the bit definitions defined in the Get Supported Media Response
734 (Table 11).

735

Table 15 – Medium change AEN format

Bytes	Bits			
	31..24	23..16	15..08	07..00
00..15	AEN Header			
16..19	Reserved			AEN Type = 0x70
20..23	Reserved			Number of Medias supported.
24..	Media descriptors			
...	Checksum			
...	Pad			

736

737 11 Packet-Based Timing Specific to MCTP Binding

738 Table 16 presents changes in the NC-SI timing parameters relative to NC-SI Packet-Based and Op-Code
 739 Timing Parameters Table in [DSP0222](#). Parameters not listed in the table below should be taken from the
 740 table in [DSP0222](#).

741

Table 16 – NC-SI Timing Parameters Specific to MCTP Binding

Name	Symbol	Value	Description
Normal Execution Interval	T5	50 ms, max	<p>Maximum time interval from when a controller receives a command to when it delivers a response to that command, unless otherwise specified.</p> <p>Measured from the rising edge of the first clock following the last bit of the command packet to the rising edge of the clock for the first bit of the response packet.</p> <p>Note: When T5 passed, an extension of the timeout should be allowed and taken into consideration under the following conditions:</p> <ol style="list-style-type: none"> 1. An Ethernet message or an NC-SI control message (AEN) being transmitted, 2. On a shared medium, the medium is occupied by other devices.

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ANNEX A (informative) Notation and conventions

747 A.1 Notations

748 Examples of notations used in this document are as follows:

- 749 • 2:N In field descriptions, this will typically be used to represent a range of byte offsets
750 starting from byte two and continuing to and including byte N. The lowest offset is on
751 the left; the highest is on the right.
- 752 • (6) Parentheses around a single number can be used in message field descriptions to
753 indicate a byte field that may be present or absent.
- 754 • (3:6) Parentheses around a field consisting of a range of bytes indicates the entire range
755 may be present or absent. The lowest offset is on the left; the highest is on the right.
- 756 • PCIe Underlined, blue text is typically used to indicate a reference to a document or
757 specification called out in "Normative references" clause or to items hyperlinked within
758 the document.
- 759 • rsvd This case-insensitive abbreviation is for "reserved."
- 760 • [4] Square brackets around a number are typically used to indicate a bit offset. Bit offsets
761 are given as zero-based values (that is, the least significant bit [LSb] offset = 0).
- 762 • [7:5] This notation indicates a range of bit offsets. The most significant bit is on the left; the
763 least significant bit is on the right.
- 764 • 1b The lowercase "b" following a number consisting of 0s and 1s is used to indicate the
765 number is being given in binary format.
- 766 • 0x12A A leading "0x" is used to indicate a number given in hexadecimal format.

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ANNEX B (informative)

Change log

Version	Date	Description
1.0.0	2013-08-22	
1.1.0	2015-03-21	Typos: <ul style="list-style-type: none"> • Fixed wrong message type in Table 6 Functional changes: <ul style="list-style-type: none"> • Stronger requirement on NC-SI control messages encapsulation. • Added specific timing requirements. • Added ability to send AEN on upcoming media status changes.
1.2.0	2017-08-26	Updated references Updated Contributors Added command to enable AENs Handled mantises Updated list of commands supported to match NC-SI 1.1
1.2.1	2018-08-23	Added reason code and response code to response format

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